The Most Powerful Cellphone Antennas in the World

June 10, 2004

Via Electronic Filing

Marlene H. Dortch, Secretary
Federal Communications Commission
Washington, DC 20554

RE: WT Docket No. 01-309

Dear Ms. Dortch:

DAMAX International (DAMAX) hereby files this status report to provide an update to the Federal Communications Commission (Commission) on its efforts to bring to market technology developed by the company that meets or exceeds the requirements adopted by the Commission in its August 14, 2003, *Report and Order* (*R&O*), Section 65, in the above-referenced docket.

I. Background

DAMAX has developed U.S. patent and patent pending proprietary antenna technology that has been proven to make digital cellular handsets noise-free to hearing aid wearers, thus solving the issue of acoustic coupling between digital cellular handsets and hearing aids covered in the aforementioned R&O. DAMAX's antenna technology works with equal effectiveness in all spectrum points from 800 MHz through 5.8 GHz. Additionally, DAMAX's technology provides other benefits including a substantial reduction in SAR and a 3 dB to 6 dB increase in carrier RF link margins. The cost of the technology is not substantially different from omni-directional antennas currently found in all digital wireless handsets.

In October 2002 DAMAX made an oral presentation, including a demonstration of its antenna technology accompanied by independent laboratory and carrier test data to representatives from the Wireless Technology Bureau.[1] In summary, the data established that DAMAX's antenna technology allowed for interference-free acoustic coupling between cellular handsets using GSM or CDMA systems and hearing aids. Following the presentation, DAMAX provided digital wireless handsets equipped with

[1] *See* DAMAX International October 21, 2002, *Ex Parte*

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DAMAX antenna technology to the Commission for further testing. The Commission's testing validated data provided during the October 21, 2002 meeting.

Since the aforementioned meeting, DAMAX has made considerable progress in further validating its technology. DAMAX continues to use its best efforts to contact and work with carriers and digital wireless handset manufacturers in the U.S. and internationally to bring the technology to market.

II. Continuing Technology Validation

Since the company's incorporation, DAMAX has welcomed efforts, whether by carriers, handset manufacturers or outside groups, to further validate the efficacy of the company's antenna technology. Indeed, DAMAX requested membership in the Alliance for Telecommunications Industry Solutions Technology Incubator Solution Program #4 (ATIS) to share its considerable expertise in RF engineering as well as data on its technology. Unfortunately, ATIS turned down the request, communicating that membership was only open to carriers and handset manufacturers, not to companies with potential solutions to the hearing aid compatibility (HAC) problem.[2] DAMAX continues to standby its offer to make available handsets equipped with its antenna technology to any carrier or handset manufacturer for further validation testing.

Besides validation and network testing that is incorporated in this report as Appendix 1, DAMAX is currently undertaking two new exciting projects that will provide greater knowledge on important aspects of the HAC issue:

1. DAMAX is currently working with a major European carrier and a respected consumer organization to carry out a large-scale human study using its technology. The study sponsors will provide 150 hearing aid users with phones equipped with DAMAX antenna technology certified as U-4 utilizing the ANSI C63.19 standard[3]. Test subjects will be asked to keep a record of their experiences using cellular phones in a quantifiable format. Many in the test group will be using cellular technology for the first time. It is hoped the study's results will help in designing educational materials that will allow the hearing impaired community to take the fullest advantage of digital cellular technology.

[2] ATIS did set up a web page where a limit of 50-word length proposals from non-member companies for solving Hearing Aid Compatibility were allowed to be cataloged and available for incubator member's use.

[3] Under the current version of the ANSI C63.19 standard, a U-4 rating denotes the highest designated rating possible. The Commission's R&O requires handsets to achieve a rating of U-3 to be considered hearing aid compatible.

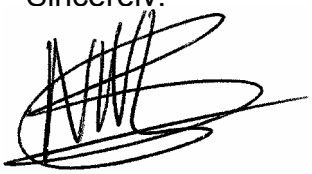
2. DAMAX is working with APREL Laboratories[4] of Toronto, Canada to further test phones equipped with the company's antenna technology using the updated ANSI C63.19 standard. DAMAX will test handsets operating in the 800-900 MHz & 1800-1900 MHZ ranges currently in the US market equipped with their standard antenna technology compared to the same model handsets equipped with DAMAX antenna technology to demonstrate the hearing aid compatibility and overall improved performance characteristics of the DAMAX equipped handsets. DAMAX will use its best efforts to design the testing methodology to dispel any issues regarding the standard's repeatability.

Upon completion of the aforementioned studies, DAMAX will present its findings to the Commission.

III. Conclusion

DAMAX continues to make substantial progress in refining and validating its technology. The company expects to enter the marketplace in the US or Europe in the very near future. DAMAX looks forward to providing a workable solution that allows hearing impaired individuals to take advantage of the digital cellular revolution, while at the same time improving cellphone performance for consumers and U.S. and European service providers.

Sincerely,



N.N. (Bill) Luxon, CEO
DAMAX International

[4]APREL Laboratories (www.aprel.com), located in Ottawa, Canada carries out research into measurement methodologies, and develops test tools for wireless, including Hearing Aid Compatibility (HAC) and Specific Absorption Rate (SAR). It is recognized by the FCC, and ISO 17025 accredited by the Standards Council of Canada, and others to conduct HAC, SAR, EMC and other critical performance tests.

Appendix 1

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U.S. FCC LABORATORY

Columbia, Maryland

DAMAX® ANTENNA EQUIPPED HANDSET SAR DATA

SAR data measured in watts per kilogram (W/kg) from FCC limit of 1.6 W/kg conducted with DAMAX equipped handsets in AMPS, 800-TDMA, PCS-TDMA, and PCS-GSM

SAR

Operating Mode	Phantom Position	Device Position	Antenna Config	Channel	Measured (W/kg)
AMPS	Left	Touch	Stub	991	0.470
				383	0.350
				799	0.272
		Tilt	Stub	991	0.331
				383	0.355, 0.320
				799	0.407
	Right	Touch	Stub	991	0.493
				383	0.352
				799	0.333
		Tilt	Stub	991	0.404
				383	0.344
				799	0.385
800 TDMA	Left	Touch	Stub	991	
				383	0.156
				799	
		Tilt	Stub	991	
				383	0.160
				799	
	Right	Touch	Stub	991	
				383	0.145
				799	
		Tilt	Stub	991	
				383	0.158
				799	
PCS TDMA	Left	Touch	Stub	2	0.121
				1000	0.136, 0.111
				1998	0.0673
		Tilt	Stub	2	0.143
				1000	0.134, 0.102
				1998	0.0554
	Right	Touch	Stub	2	0.144
				1000	0.179
				1998	0.0980
		Tilt	Stub	2	0.168
				1000	0.167
				1998	0.0795

FCC LABORATORY
DAMAX ANTENNA EQUIPPED HANDSET SAR DATA

Reduction in power loss registered by DAMAX equipped PCS-GSM handset measured in W/kg from FCC limit of 1.6 W/kg

SAR

Operating Mode	Phantom Position	Device Position	Antenna Config	Channel	Measured (W/kg)
PCS GSM	Left	Touch	Stub	512	0.0166
				661	0.0159, 0.00565*
				810	0.0199
		Tilt		512	0.0125
				661	0.0146, 0.00589*
				810	0.0038
	Right	Touch	Stub	512	0.0092
				661	0.0063
				810	0.0048
		Tilt		512	0.0061
				661	0.0059
				810	0.0033

SUMMARY

FCC tests show DAMAX reduced SAR (the specific absorption rate of RF radiation in 1 kilogram of tissue emitted from handsets toward users) to as low as 0.272 in AMPS, 0.145 in 800-TDMA, 0.0554 in PCS-TDMA, and 0.0033 in PCS-GSM. Because manufacturers desire to transmit as much signal power as is permitted under the law, many handsets with omni-directional antennas test at or near the 1.6 limit.

ETS LINDGREN LABORATORIES
Cedar Park, Texas

Total Radiated & Near Horizon Partial Radiated Power Test Results

ETS Lindgren tests also show that by virtually eliminating handset power loss to the user, DAMAX makes up to four times more handset power available in total radiated power and near horizon partial radiated power for carrier networks to use – while remaining 80% below FCC peak EIRP limits.

TOTAL RADIATED POWER

Model	**Nokia 6340i w/std Antenna**			**Nokia 6340i w/DAMAX Antenna**		
SN	073/12683660			TBD		
Band	GSM-1900			GSM-1900		
Channel	512	661	810	512	661	810
Frequency (MHz)	1850.2	1880	1850.2	1850.2	1880	1850.2
Phantom Head-Left Ear:						
Ant. Port Input Pwr. (dBm)	30	30	30	30	30	30
Tot. Rad. Pwr. (dBm)	24.2817	23.6636	21.6069	26.6045	26.8941	24.9458
Average increase in Total Radiated Power (dBm):				**2.3228**	**3.2305**	**3.3389**

NEAR HORIZON PARTIAL RADIATED POWER (NHPRP)

	Phantom Head-Left Ear / GSM-1900								
Frequency (MHz):	1850.2			1880			1909.8		
	Nokia 6340i	Nokia 6340i w/DAMAX Antenna	Gain	Nokia 6340i	Nokia 6340i w/DAMAX Antenna	Gain	Nokia 6340i	Nokia 6340i w/DAMAX Antenna	Gain
NHPRP +/-Pi/4 (dBm)	23.17	25.25	2.08	22.60	25.57	2.97	20.40	23.63	3.22
NHPRP +/-Pi/6 (dBm)	21.76	23.83	2.06	21.19	24.17	2.98	18.89	22.18	3.30
NHPRP +/-Pi/8 (dBm)	20.64	22.72	2.08	20.06	23.07	3.01	17.70	21.06	3.37
Average Increase in NHPRP:			***2.07***			***2.99***			***3.30***

ETS LINDGREN [*1]

A CTIA Authorized Test Lab (CATL)

DAMAX GSM-1900 TEST DATA SUMMARY

Model	**Nokia 6340i w/std Antenna**			**Nokia 6340i w/DAMAX Antenna**		
SN	073/12683660			TBD		
Band	GSM-1900			GSM-1900		
Channel	512	661	810	512	661	810
Frequency (MHz)	1850.2	1880	1850.2	1850.2	1880	1850.2
Phantom Head-Left Ear:						
Ant. Port Input Pwr. (dBm)	30	30	30	30	30	30
Tot. Rad. Pwr. (dBm)	24.2817	23.6636	21.6069	26.6045	26.8941	24.9458
Peak EIRP (dBm)	30.5266	29.988	27.7774	30.5259	31.0229	29.1092
Directivity (dBi)	6.24481	6.3244	6.17049	3.92147	4.12886	4.16338
Efficiency (dB)	-5.71825	-6.33641	-8.39309	-3.39552	-3.10594	-5.05419
Gain (dBi)	0.526556	-0.01202	-2.2226	0.525944	1.02292	-0.89081
NHPRP +/-Pi/4 (dBm)	23.1714	22.5999	20.4021	25.2508	25.5739	23.6256
NHPRP +/-Pi/6 (dBm)	21.7631	21.1875	18.8883	23.8259	24.1698	22.1839
NHPRP +/-Pi/8 (dBm)	20.6438	20.0629	17.696	22.7205	23.0714	21.0629
Front/Back Ratio (dB)	14.5179	15.2116	10.2728	6.56517	6.82509	7.46186
Phi BW (º)	120	121	120	125	122	119
+ Phi BW (º)	91	91	91	34	33	28
-Phi BW (º)	29	30	29	91	89	91
Theta BW	60	61	53	131	130	134
+Th. BW (º)	28	28	26	40	39	43
-Th. BW (º)	32	33	27	91	91	91
Boresight Phi (º)	45	45	45	150	150	150
Boresight Th. (º)	120	120	120	105	105	105
Maximum Power (dBm)	30.5266	29.988	27.7774	30.5259	31.0229	29.1092
Minimum Power (dBm)	7.62703	6.21286	0.393309	12.8782	12.4024	11.8638
Average Power (dBm)	23.7302	22.9769	21.2669	26.4605	26.7026	24.7499
Max/Min Ratio (dB)	22.8995	23.7751	27.3841	17.6478	18.6205	17.2454
Max/Avg Ratio (dB)	6.79635	7.01104	6.51053	4.0654	4.32034	4.35933
Min/Avg Ratio (dB)	-16.1032	-16.7641	-20.8736	-13.5824	-14.3001	-12.8861
Avg. 6340i w/DAMAX Antenna increase in Tot. Rad. Pwr. (dBm)				**2.3228**	**3.2305**	**3.3389**

[*1] ETS Lindgren is a CTIA accredited test laboratory (CATL) for Antenna Testing per CTIA Antenna Test Plan Revision 2.0 in the full range of TDMA, CDMA, AMPS, and GSM. The ETS lab is also accredited by the American Association of Laboratory Accreditation (A2LA), which has mutual recognition agreements with other laboratory accreditation systems worldwide. In addition to the U.S., ETS laboratories are located in Brazil, China, Finland, France, Japan, Singapore, and the UK.

ETS LINDGREN

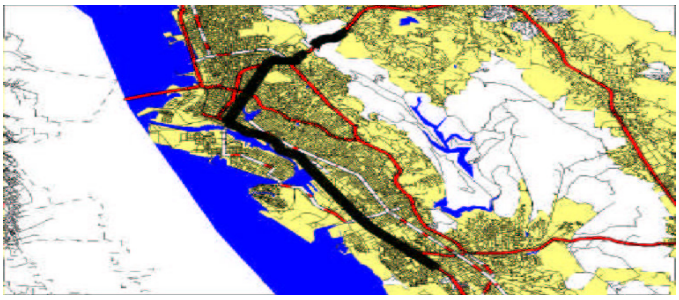
A CTIA Authorized Test Lab (CATL)

DAMAX TDMA-800 TEST DATA SUMMARY

Model	**Nokia 6340i w/std Antenna**			**Nokia 6340i w/DAMAX Antenna**		
SN	073/12683660			TBD		
Band	TDMA-800			TDMA-800		
Channel	991	384	799	991	384	799
Frequency (MHz)	824.04	836.52	848.97	824.04	836.52	848.97
Phantom Head-Left Ear:						
Ant. Port Input Pwr. (dBm)	28	28	28	28	28	28
Tot. Rad. Pwr. (dBm)	20.3586	20.034	19.4966	25.1841	24.4771	25.4516
Peak EIRP (dBm)	24.8463	24.9823	24.7566	29.5463	28.5319	29.7122
Directivity (dBi)	4.48764	4.94831	5.26004	4.36227	4.05482	4.26064
Efficiency (dB)	-7.64137	-7.96603	-8.50342	-2.81594	-3.52292	-2.54839
Gain (dBi)	-3.15372	-3.01772	-3.24338	1.54633	0.531903	1.71225
NHPRP +/-Pi/4 (dBm)	18.9029	18.643	18.1801	23.843	23.2029	24.2517
NHPRP +/-Pi/6 (dBm)	17.4282	17.2032	16.7783	22.4355	21.8281	22.9338
NHPRP +/-Pi/8 (dBm)	16.2924	16.0867	15.6763	21.3623	20.7392	21.8695
Front/Back Ratio (dB)	6.97763	8.29127	9.15791	4.13451	5.56314	6.86732
Phi BW (º)	90	86	86	113	125	125
+ Phi BW (º)	40	39	39	52	70	66
-Phi BW (º)	50	47	47	61	55	59
Theta BW	134	136	104	105	131	128
+Th. BW (º)	44	45	48	45	63	62
-Th. BW (º)	90	91	56	60	68	66
Boresight Phi (º)	60	60	60	45	45	45
Boresight Th. (º)	90	90	90	105	105	105
Maximum Power (dBm)	24.8463	24.9823	24.7566	29.5463	28.5319	29.7122
Minimum Power (dBm)	9.65589	9.18341	8.87162	11.6365	12.4604	15.3989
Average Power (dBm)	20.2717	19.9794	19.3508	25.1124	24.2026	25.0751
Max/Min Ratio (dB)	15.1904	15.7989	15.885	17.9099	16.0715	14.3133
Max/Avg Ratio (dB)	4.57462	5.00286	5.40587	4.43391	4.32934	4.63714
Min/Avg Ratio (dB)	-10.6158	-10.796	-10.4791	-13.476	-11.7422	-9.67617
Avg. 6340i w/DAMAX Antenna increase in Tot. Rad. Pwr. (dBm)				**4.8255**	**4.4431**	**5.955**

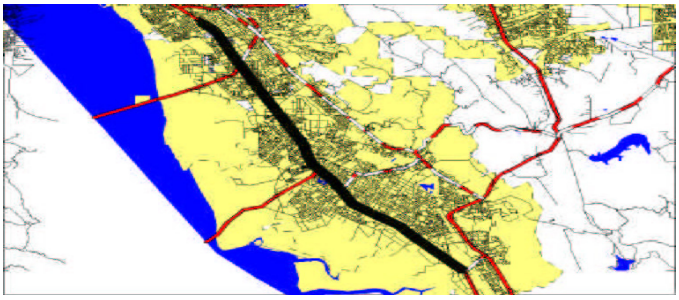
ZK CELLTEST
Santa Clara, California

100-mile drive tests in GSM and CDMA Networks through rural, suburban, light industrial, urban, and dense urban environments



CONCLUSION

GSM 1900 MHz 100 MILE DRIVE TEST: ZK Celltest determined that the handsets offer nearly identical performance. The one exception is Transmit Power where the DAMAX directional antenna indicated improvement above the margin of error in two of the four portions of the test.



CONCLUSION

CDMA 100 MILE DRIVE TEST: ZK Celltest determined the handset with the DAMAX directional antenna showed improvement in both receive signal level and frame error rate with both measurements indicating improvement above the margin of error.

NOTE: The GSM and CDMA networks are well established in the test area with numerous cell sites spaced close together along the drive test route. ZK Celltest estimates that in areas where cell sites are spaced further apart, DAMAX capability to deliver 2 dB to 6 dB more power to GSM and CDMA networks could be expected to provide greater performance advantages.

APREL LABORATORIES
Ontario, Canada

Hearing Aid Compatibility Tests[*5]

APREL Engineer & DAMAX Equipped
Handset in RF Test Equipment

[*5] Conducted by APREL Laboratories to ANSI / IEEE C63.19 Standards. APREL Laboratories is recognized by the FCC, and ISO 17025 accredited by the Standards Council of Canada, and others to conduct HAC, SAR, and other critical performance tests.

The purpose of the categorization (U1, U2 etc.) is to establish categories for hearing aids and for telephones that can indicate to health care practitioners and hearing aid users which hearing aids are compatible with which telephone. Tests are performed to assess the electromagnetic characteristics of hearing aids and telephones and assign them to these categories. In this case, the telephone is tested for the E-field and H-field emissions while the hearing aid is tested for E-field and H-field immunity and based on the results they are categorized.

For telephone, Category U4 has lower emission levels than the U1, which means less interference to the hearing aid. For hearing aid, Category U4 has higher immunity level than the U1, which means it can endure higher interference signal level. When this category number of telephone is summed up with the category number of the hearing aid, it provides a total system performance classification. A “U” category sum greater than or equal to 6 provides an excellent performance.

Near Field Parameters For Cell Phones

RF Parameters

	E-Field Emissions	H-Field Emissions
	(CW dB (V/m))	(CW dB (A/m)
Category U1	46 - 51 dB (V/m) + 0.5 x AWF	-4.4 - 0.6 dB (A/m) + 0.5 x AWF
Category U2	41 - 46 dB (V/m) + 0.5 x AWF	-9.4 - -4.4 dB (A/m) + 0.5 x AWF
Category U3	36 - 41 dB (V/m) + 0.5 x AWF	-14.4 - -9.4 dB (A/m) + 0.5 x AWF
Category U4	< 36 dB (V/m) + 0.5 x AWF	< -14.4 dB (A/m) + 0.5 x AWF

System Performance Classification Tables

System Classification	Articulation Index	U Category Sum
	AI	Sum of hearing aid (U category) + Telephone (U category)
Usable	0.3	Hearing Aid (U category) + Telephone (U category) = 4
Normal Use	0.5	Hearing Aid (U category) + Telephone (U category) = 5
Excellent Performance	0.7	Hearing Aid (U category) + Telephone (U category) > = 6

HEARING AID COMPATIBILITY TEST RESULTS

APREL Laboratories
ANSI C63.19 DAMAX Test Results

GSM 1900 Handset

This engineering evaluation report presents the results of the hearing aid compatibility (HAC) tests performed on two GSM 1900 handsets, one equipped with its original omni-directional antenna, and the other equipped with a DAMAX directional antenna. The results are categorized as described below.

RF E-Field

Antenna	E (V/m)	E (dBV/m	Category
Original	189.74	45.6	U1
DAMAX	41.95	32.5	U4

RF H-Field

Antenna	H (A/m)	H (dBA/m	Category
Original	0.173	-6.2	U1
DAMAX	0.041	-18.8	U4

HEARING AID COMPATIBILITY TEST RESULTS

APREL Laboratories
ANSI C63.19 DAMAX Test Results

CDMA 1900 Handset

This engineering evaluation report presents the results of the hearing aid compatibility (HAC) tests performed on two CDMA 1900 handsets, one equipped with its original omni-directional antenna, and the other equipped with a DAMAX directional antenna. The results are categorized as described below.

RF E-Field

Antenna	E (V/m)	E (dBV/m	Category
Original	114.07	41.1	U2
DAMAX	44.63	33.0	U4

RF H-Field

Antenna	H (A/m)	H (dBA/m	Category
Original	0.404	-7.9	U2
DAMAX	0.147	-16.7	U4

SUMMARY

DAMAX equipped GSM and CDMA handsets tested U4, the highest phone hearing aid compatibility rating designated under C 63.19. The same model phones with their standard antennas tested U1 (GSM) and U2 (CDMA), the lowest HAC ratings under C 63.19.

APREL LABORATORIES
DAMAX EQUIPPED HANDSET EIRP[*1] TESTS

Kyocera 2345 Cellphone, September 2003

EIRP

(Equivalent Isotropically Radiated Power)

Antenna	EIRP (dBm)	EIRP (W)	FCC Limit (W)
Original Antenna	24.0	0.251	2.0
DAMAX Antenna	25.3	0.336	2.0

In accordance with FCC Part 24E PCS Broadband mobile/portable stations, Mobile /portable stations are limited to 2 watts E.I.R.P. As shown above, the EIRP of the Kyocera 2345 cellphone using DAMAX antenna is within the FCC limit with a margin of 1.664W.

The EIRP was measured in APREL's FCC listed Open Area Test Site (OATS), and is much below the FCC limit. In summary, due to DAMAX directional antenna the EIRP does not exceed the limit, and is up by only a small amount (0.085W).

APREL Laboratories (www.aprel.com), located in Ottawa, Ontario, Canada carries out research into measurement methodologies, and develops test tools for wireless, including Hearing Aid Compatibility (HAC) and Specific Absorption Rate (SAR). It is recognized by the FCC, and ISO 17025 accredited by the Standards Council of Canada, and others to conduct HAC, SAR, EMC and other critical performance tests.

[*1] EIRP (Equivalent Isotropically Radiated Power) is the product of the power supplied to the antenna, and the antenna gain in a given direction relative to an isotropic antenna.

SIGNAL ANTENNA SYSTEMS

Watsonville, California

Anechoic Chamber Antenna Test Data Summary

FOCUSED POWER™ ANTENNA PATTERN PLOTS

Plot 1 sweeps the 1710 - 1880 MHz band and Plot 2 the 1850 - 1990 MHz band. Each 360o circular plot line marks a gain or reduction of + or - 5 dB of signal power. The reduction in handset power, normally absorbed by the user, is shown by the curving lines between 135o and 225o in the pattern where the user is normally positioned.

DAMAX antenna performance delivers a >20 – 30 dB null in the pattern between 135o and 225o, which translates to approximately 1/80th of the radiated power normally emitted in this direction by typical omni antennas.

- Note: Radiated power measured in Decibels (dB) is logarithmic. For example:
    I. 10 dB rejection is equivalent to 1/10th the radiated power
    II. 20 dB rejection is equivalent to 1/100th the radiated power
    III. 30 dB rejection is equivalent to 1/1000th the radiated power
- Typical omni antennas may have up to +1 dB gain at peak in the transmit (Tx) band. This can be found in pull-up whip antennas but is unlikely in an embedded antenna design. The receive (Rx) band is typically below 0 dB, which translates to a negative gain or loss.
- The rejection at 180o from the DAMAX antenna results in a greater than 98% reduction in user SAR over typical omni antennas, which permits DAMAX equipped handsets to be accurately and fairly represented as "The Lowest SAR Phones in the World."
- DAMAX focused power™ antenna gain in the +90o to -90o hemispherical plane averages +3 dB to +4 dB. (Note: +3 dB doubles the radiated power, increasing handset range by 50%.)
- Dependent upon how phones are held during use, user hands create 2 dB to 6 dB of signal loss through signal absorption into the hand. However, the shape of DAMAX antenna housings, with self-contained ground planes, are designed to keep user hands away from the antenna, which substantially reduces power loss to the hand.

Body SAR: DAMAX virtually eliminates body SAR. All DAMAX equipped phones come with carrying cases and/or belt or backpack clips that face the antenna away from the user. In addition, due to a 5 dB null in DAMAX patterns at 0o, even if handsets are

positioned with the antenna next to the body the resultant SAR is no higher than a typical omni equipped phone in the same position.

Note: DAMAX equipped handsets remain more than 80% below FCC peak EIRP limits.

SIGNAL ANTENNA SYSTEMS INC

For use with CDI turn table and Panther LI controller

Nokia 6310i

Chamber

SAS1

DATE

2/2/2004

TIME

12:48 PM

TEST PARAMETERS

Tx POLARIZATION

Horizontal

ROTATION

Elevation 1

ANTENNA DESCRIPTION

DATA: GAIN/ABSOLUTE A/G

Gain

FREQUENCY BAND

D C S

FILE NAME

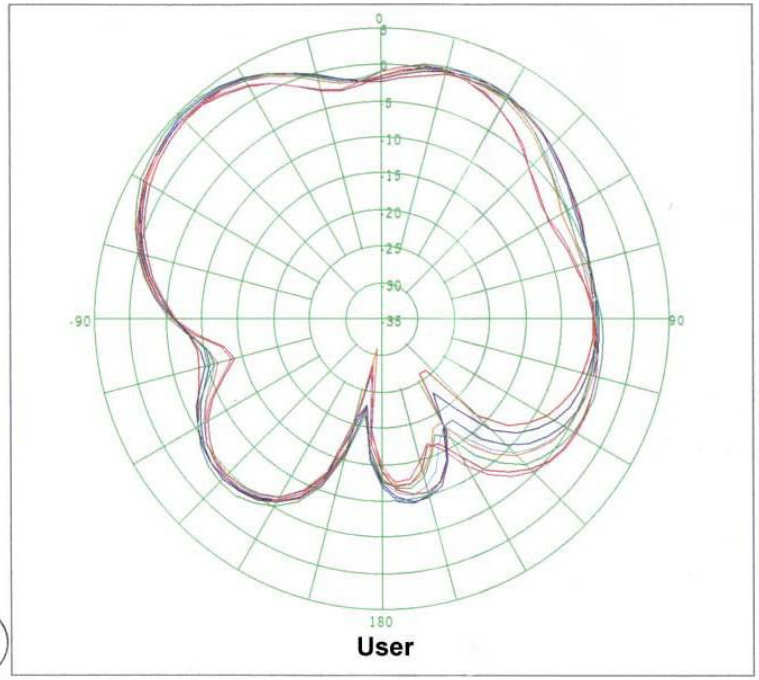
C:\damax\#2

Test Parameter Setup

Calibrate Dipole

Recall Data

START TEST



Degrees per Data Point: 5

CARTESIAN POLAR

Pattern Presentation

Scale Minimum: -35 dB

Scale Maximum: 5 dB

Rescale

BEAM PEAK

Freq(MHz)	Degree	dB(Abs)	dBi(Gain)
1710.0	320.00	-32.92	3.6625
1730.0	315.00	-32.76	4.0355
1750.0	315.00	-32.49	4.3421
1770.0	315.00	-32.70	4.0961
1795.0	315.00	-33.10	4.0003
1820.0	315.00	-33.33	4.7699
1860.0	310.00	-34.41	3.7855
1880.0	315.00	-34.18	3.9847

Avg Gain -42.49

SIGNAL ANTENNA SYSTEMS INC

For use with CDI turn table and Panther LI controller

Samsung SGH-X105

TEST PARAMETERS

Tx POLARIZATION
Horizontal

ROTATION
Elevation 1

ANTENNA DESCRIPTION

DATA: GAIN/ABSOLUTE
Gain

A/G

FREQUENCY BAND
D C S

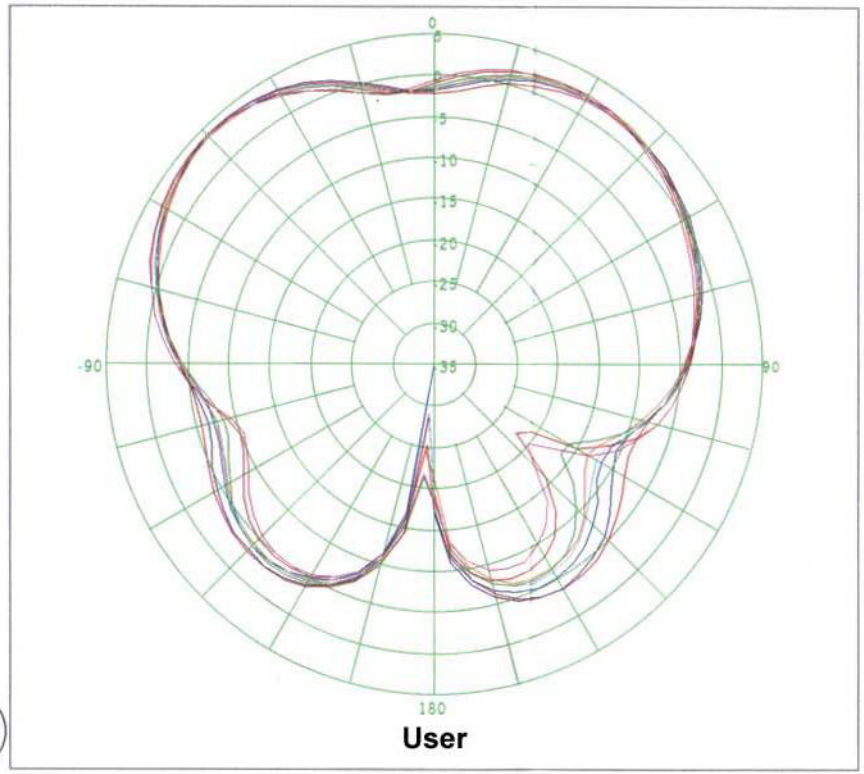
FILE NAME
samsung1710 1880

Test Parameter Setup

Calibrate Dipole

Recall Data

START TEST



Degrees per Data Point: 5

CARTESIAN POLAR

Pattern Presentation

Scale Minimum: -35 dB

Scale Maximum: 5 dB

Rescale

Chamber
SAS1

DATE
2/3/2004

TIME
12:39 PM

BEAM PEAK

Freq(MHz)	Degree	dB(Abs)	dBi(Gain)
1710.0	320.00	-32.78	3.8109
1730.0	315.00	-32.74	4.0570
1750.0	315.00	-32.99	3.8382
1770.0	315.00	-32.87	3.9242
1795.0	315.00	-33.32	3.7738
1820.0	315.00	-34.20	3.8949
1860.0	315.00	-34.11	4.0863
1880.0	315.00	-34.27	3.9007

Avg Gain -3.823

SIGNAL ANTENNA SYSTEMS INC

For use with CDI turn table and Panther LI controller

TEST PARAMETERS

Tx POLARIZATION
Horizontal

ROTATION
Elevation 1

ANTENNA DESCRIPTION

DATA: GAIN/ABSOLUTE
Gain A/G

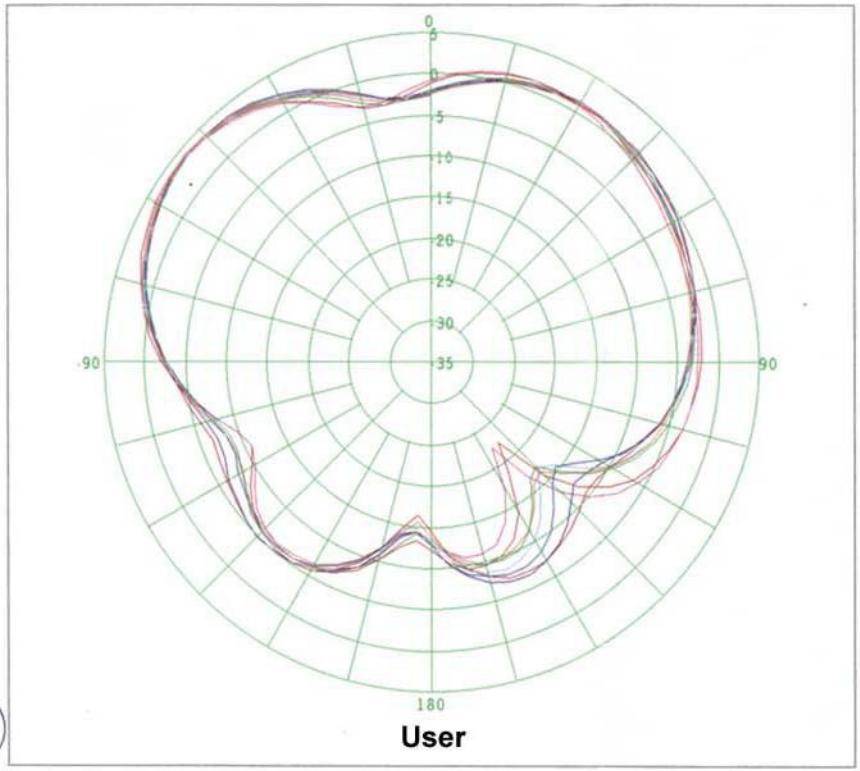
FREQUENCY BAND
D C S

FILE NAME
C:\damax\SVP 1710

Test Parameter Setup

Calibrate Dipole Recall Data

START TEST



User

Degrees per Data Point: 5

CARTESIAN POLAR

Pattern Presentation

Scale Minimum: -35 dB

Scale Maximum: 5 dBi

Rescale

SVP (Orange)

Chamber
SAS1

DATE
2/2/2004

TIME
2:27 PM

BEAM PEAK

Freq(MHz)	Degree	dB(Abs)	dBi(Gain)
1710.0	315.00	-32.81	3.7777
1730.0	310.00	-32.76	4.0316
1750.0	310.00	-33.02	3.8089
1770.0	310.00	-32.74	4.0589
1795.0	310.00	-33.19	3.9066
1820.0	310.00	-34.29	3.8109
1860.0	310.00	-34.08	4.1195
1880.0	310.00	-34.29	3.8773

Avg Gain -41.42

March 30, 2004

OVERVIEW OF HUMAN AND HEARING AID TESTING

On March 24, 2004, a major European hearing-impaired consumer organization arranged for testing of handsets equipped with Damax directional antenna technology with hearing aids in two different environments. The handsets were models used by a leading European cellular service provider, and the tests were conducted in London, England.

The phones selected for testing, and equipped with Damax were the Nokia 6310i and the Samsung X-100. Both phones are currently available for sale in the UK. Testing was divided into two segments. The first segment involved testing the phones with individuals who use hearing aids. The second segment involved testing hearing aids attached to an amplifier with the phones. Below is an overview of both segments:

SEGMENT 1

This segment involved the testing of the phones by hearing impaired individuals who use hearing aids in their day-to-day lives. The test set-up included two rooms inside a building located in central London. Both phones mentioned above were equipped with Damax directional antenna technology. Both phones were operating at 75% peak antenna strength due to the location of the testing.

The test methodology required the subject to locate in an adjoining “quiet room” where he or she could not hear or see the control. A call was placed to the test subject from another cellular phone and a 5-10 minute conversation was carried on. During the test conversation, subjects were asked to rate any interference in the phone and their ability to understand and communicate. The subject was also asked to try to communicate with their hearing aids set in telecoil mode.

All subjects had moderate hearing losses except one whose loss would be classified as profound. All aids tested were behind-the-ear models considered the most susceptible to interference. Hearing aids used in the tests included digital and analog products manufactured by Oticon, Phonak, Widex, and Siemens. Tested hearing aid included all analog and digital aids that have been dispensed by the British National Health Service (“NHS”) during the past five (5) years).

In every instance but one the test subjects were able to use the Damax equipped phones and carry on conversations with the control. Once subjects became familiar with the technology, they rated the coupling as excellent or very good, and the “buzzing” usually caused by digital cellular GSM phones was either eliminated or substantially reduced. There was one instance where a subject

was unable to communicate with the phone. As the subject was profoundly hearing impaired, had never used a cellular phone, and had difficulties using landline phones, it was agreed that his inability to use the cellular phone was caused by his profound hearing loss that negated his ability to acoustically couple with the phone.

Subjects reported that the coupling was much better in regular acoustic mode than in telecoil mode, which was expected. As a control, subjects were asked to use an "off the shelf" Sanyo clamshell model. In many instances, subjects were able to communicate using the phone. It should be noted that the Sanyo phone was operating in its lowest power mode, and when later tested with other aids produced substantial interference.

SEGMENT 2

This segment consisted of testing hearing aids that have been offered, currently and in the past, by the British NHS. The hearing aids ranged from older analog aids with little or no immunity, to newer lower end digital aids with improved immunity currently being dispensed by NHS. The aids were connected to a Radio Shack model 227-1008 amplifier, which was connected to a Radio Shack model 33-3026 microphone, which coupled with the respective hearing aid through a 10-inch section of clear plastic tubing. The set-up was designed to reduce feedback from the hearing aid.

Hearing aids manufactured by Phonak, Oticon and Siemens were attached to the aforementioned amplifying device and placed in a position that would replicate a hearing aid wearer using a cellular phone. In every instance the hearing aids exhibited little or no interference when placed next to a Damax equipped phone speaker.

CONCLUSION

It was agreed that the DAMAX equipped cellular phones allowed hearing aid wearers to use digital cellular phones operating on a GSM system. It was further agreed that testing involving a larger subject base was needed to learn more about use patterns, and provide a greater body of data.